

AS & A Level Mathematics (9709) Paper 5

[Probability & Statistics 1]

Exam Series: May 2015 – May 2022

Format Type A:

Answers to all questions are provided as an appendix

Chapter 3

Probability

- (b) Find the probability that all 3 eggs chosen contain a yellow sweet, given that all three children have the same colour sweet. [2]

.....

.....

.....

.....

.....

.....

.....

.....

.....

- (c) Find the probability that at least one of Hanna's three children chooses an egg that contains an orange sweet. [3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

134. 9709_s22_qp_53 Q: 6

Sajid is practising for a long jump competition. He counts any jump that is longer than 6 m as a success. On any day, the probability that he has a success with his first jump is 0.2. For any subsequent jump, the probability of a success is 0.3 if the previous jump was a success and 0.1 otherwise. Sajid makes three jumps.

- (a) Draw a tree diagram to illustrate this information, showing all the probabilities. [2]

135. 9709_m21_qp_52 Q: 2

Georgie has a red scarf, a blue scarf and a yellow scarf. Each day she wears exactly one of these scarves. The probabilities for the three colours are 0.2, 0.45 and 0.35 respectively. When she wears a red scarf, she always wears a hat. When she wears a blue scarf, she wears a hat with probability 0.4. When she wears a yellow scarf, she wears a hat with probability 0.3.

- (a) Find the probability that on a randomly chosen day Georgie wears a hat. [2]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

- (b) Find the probability that on a randomly chosen day Georgie wears a yellow scarf given that she does not wear a hat. [3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....



137. 9709_s21_qp_51 Q: 4

To gain a place at a science college, students first have to pass a written test and then a practical test.

Each student is allowed a maximum of two attempts at the written test. A student is only allowed a second attempt if they fail the first attempt. No student is allowed more than one attempt at the practical test. If a student fails both attempts at the written test, then they cannot attempt the practical test.

The probability that a student will pass the written test at the first attempt is 0.8. If a student fails the first attempt at the written test, the probability that they will pass at the second attempt is 0.6. The probability that a student will pass the practical test is always 0.3.

(a) Draw a tree diagram to represent this information, showing the probabilities on the branches.

[3]

(b) Find the probability that a randomly chosen student will succeed in gaining a place at the college.

[2]

.....

.....

.....

.....

.....

.....

Four letters are selected at random from the 8 letters of the word TOMORROW.

(c) Find the probability that the selection contains at least one O and at least one R. [5]

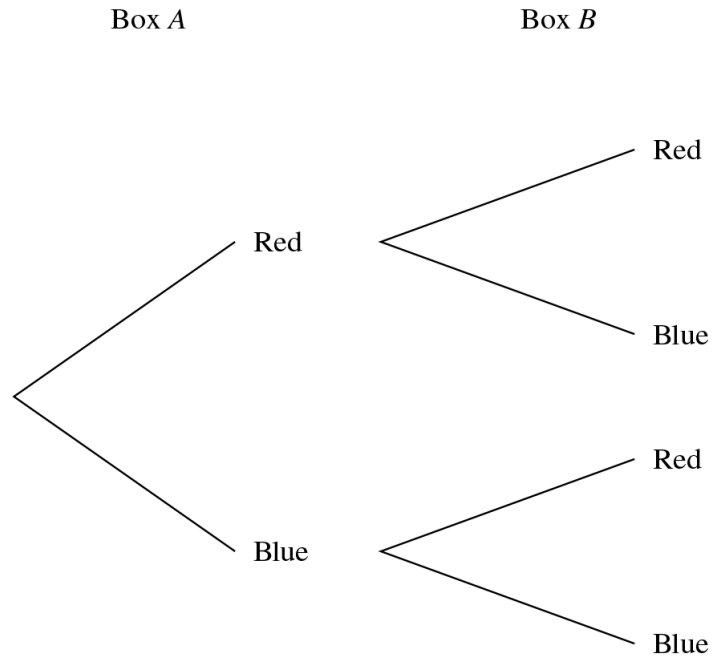
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....



145. 9709_m20_qp_52 Q: 6

Box *A* contains 7 red balls and 1 blue ball. Box *B* contains 9 red balls and 5 blue balls. A ball is chosen at random from box *A* and placed in box *B*. A ball is then chosen at random from box *B*. The tree diagram below shows the possibilities for the colours of the balls chosen.

(a) Complete the tree diagram to show the probabilities. [3]



- (b) Find the probability that the two balls chosen are not the same colour. [2]

.....

.....

.....

.....

.....

.....

.....

.....

.....

- (c) Find the probability that the ball chosen from box *A* is blue given that the ball chosen from box *B* is blue. [4]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

146. 9709_s20_qp_51 Q: 5

On Mondays, Rani cooks her evening meal. She has a pizza, a burger or a curry with probabilities 0.35, 0.44, 0.21 respectively. When she cooks a pizza, Rani has some fruit with probability 0.3. When she cooks a burger, she has some fruit with probability 0.8. When she cooks a curry, she never has any fruit.

- (a) Draw a fully labelled tree diagram to represent this information. [2]

148. 9709_s20_qp_53 Q: 1

Juan goes to college each day by any one of car or bus or walking. The probability that he goes by car is 0.2, the probability that he goes by bus is 0.45 and the probability that he walks is 0.35. When Juan goes by car, the probability that he arrives early is 0.6. When he goes by bus, the probability that he arrives early is 0.1. When he walks he always arrives early.

(a) Draw a fully labelled tree diagram to represent this information. [2]

(b) Find the probability that Juan goes to college by car given that he arrives early. [4]

.....

.....

.....

.....

.....

.....

.....

.....

.....

151. 9709_w20_qp_51 Q: 2

The probability that a student at a large music college plays in the band is 0.6. For a student who plays in the band, the probability that she also sings in the choir is 0.3. For a student who does not play in the band, the probability that she sings in the choir is x . The probability that a randomly chosen student from the college does not sing in the choir is 0.58.

(a) Find the value of x . [3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

Two students from the college are chosen at random.

(b) Find the probability that both students play in the band and both sing in the choir. [2]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....



Let X be the event that 1 April is fine and Y be the event that 3 April is rainy.

(c) Find the value of $P(X \cap Y)$. [3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(d) Find the probability that 1 April is fine given that 3 April is rainy. [3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

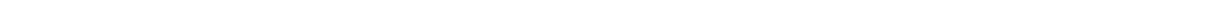
.....

.....

.....

.....

.....



All 9 people stand in a line.

- (c) Find the number of different arrangements in which Mr Ahmed is not standing next to Mr Baker. [3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

- (d) Find the number of different arrangements in which there is exactly one person between Mr Ahmed and Mr Baker. [3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....



155. 9709_w20_qp_53 Q: 5

The 8 letters in the word RESERVED are arranged in a random order.

- (a) Find the probability that the arrangement has V as the first letter and E as the last letter. [3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

- (b) Find the probability that the arrangement has both Rs together given that all three Es are together. [4]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

156. 9709_m19_qp_62 Q: 1

On each day that Tamar goes to work, he wears either a blue suit with probability 0.6 or a grey suit with probability 0.4. If he wears a blue suit then the probability that he wears red socks is 0.2. If he wears a grey suit then the probability that he wears red socks is 0.32.

- (i) Find the probability that Tamar wears red socks on any particular day that he is at work. [2]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

- (ii) Given that Tamar is not wearing red socks at work, find the probability that he is wearing a grey suit. [3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....



162. 9709_w19_qp_62 Q: 2

Benju cycles to work each morning and he has two possible routes. He chooses the hilly route with probability 0.4 and the busy route with probability 0.6. If he chooses the hilly route, the probability that he will be late for work is x and if he chooses the busy route the probability that he will be late for work is $2x$. The probability that Benju is late for work on any day is 0.36.

(i) Show that $x = 0.225$. [2]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(ii) Given that Benju is not late for work, find the probability that he chooses the hilly route. [3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....



165. 9709_m18_qp_62 Q: 3

Last Saturday, Sarah recorded the colour and type of 160 cars in a car park. All the cars that were not red or silver in colour were grouped together as ‘other’. Her results are shown in the following table.

		Type of car		
		Saloon	Hatchback	Estate
Colour of car	Red	20	40	12
	Silver	14	26	10
	Other	6	24	8

- (i) Find the probability that a randomly chosen car in the car park is a silver estate car. [1]

.....

.....

- (ii) Find the probability that a randomly chosen car in the car park is a hatchback car. [1]

.....

.....

- (iii) Find the probability that a randomly chosen car in the car park is red, given that it is a hatchback car. [2]

.....

.....

.....

.....

- (iv) One of the cars in the car park is chosen at random. Determine whether the events ‘the car is a hatchback car’ and ‘the car is red’ are independent, justifying your answer. [2]

.....

.....

.....

.....

.....

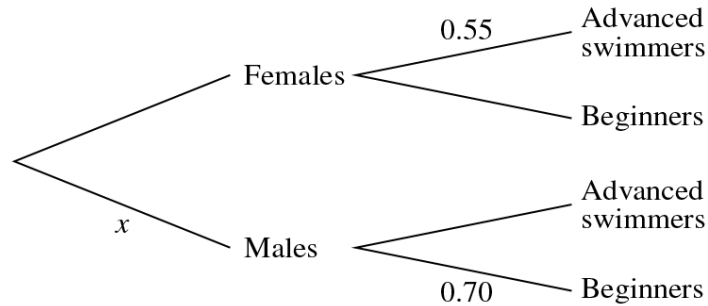
.....

.....

.....

167. 9709_s18_qp_63 Q: 3

The members of a swimming club are classified either as ‘Advanced swimmers’ or ‘Beginners’. The proportion of members who are male is x , and the proportion of males who are Beginners is 0.7. The proportion of females who are Advanced swimmers is 0.55. This information is shown in the tree diagram.



For a randomly chosen member, the probability of being an Advanced swimmer is the same as the probability of being a Beginner.

- (i) Find x . [3]

.....

.....

.....

.....

.....

.....

.....

- (ii) Given that a randomly chosen member is an Advanced swimmer, find the probability that the member is male. [3]

.....

.....

.....

.....

.....

.....

168. 9709_w18_qp_61 Q: 7

In a group of students, the numbers of boys and girls studying Art, Music and Drama are given in the following table. Each of these 160 students is studying exactly one of these subjects.

	Art	Music	Drama
Boys	24	40	32
Girls	15	12	37

- (i) Find the probability that a randomly chosen student is studying Music. [1]

.....

.....

.....

- (ii) Determine whether the events ‘a randomly chosen student is a boy’ and ‘a randomly chosen student is studying Music’ are independent, justifying your answer. [2]

.....

.....

.....

.....

.....

.....

.....

- (iii) Find the probability that a randomly chosen student is not studying Drama, given that the student is a girl. [2]

.....

.....

.....

.....

.....

.....

.....

169. 9709_w18_qp_62 Q: 1

(i) How many different arrangements are there of the 11 letters in the word MISSISSIPPI? [2]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

ii) Two letters are chosen at random from the 11 letters in the word MISSISSIPPI. Find the probability that these two letters are the same. [3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....



175. 9709_s17_qp_63 Q: 3

A shop sells two makes of coffee, Café Premium and Café Standard. Both coffees come in two sizes, large jars and small jars. Of the jars on sale, 65% are Café Premium and 35% are Café Standard. Of the Café Premium, 40% of the jars are large and of the Café Standard, 25% of the jars are large. A jar is chosen at random.

- (i) Find the probability that the jar is small. [2]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

- (ii) Find the probability that the jar is Café Standard given that it is large. [3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

176. 9709_w17_qp_61 Q: 5

Over a period of time Julian finds that on long-distance flights he flies economy class on 82% of flights. On the rest of the flights he flies first class. When he flies economy class, the probability that he gets a good night's sleep is x . When he flies first class, the probability that he gets a good night's sleep is 0.9.

- (i) Draw a fully labelled tree diagram to illustrate this situation. [2]

The probability that Julian gets a good night's sleep on a randomly chosen flight is 0.285.

- (ii) Find the value of x . [2]

.....

.....

.....

.....

.....

.....

.....

.....

.....

179. 9709_m16_qp_62 Q: 3

A fair eight-sided die has faces marked 1, 2, 3, 4, 5, 6, 7, 8. The score when the die is thrown is the number on the face the die lands on. The die is thrown twice.

- Event R is 'one of the scores is exactly 3 greater than the other score'.
- Event S is 'the product of the scores is more than 19'.

(i) Find the probability of R . [2]

(ii) Find the probability of S . [2]

(iii) Determine whether events R and S are independent. Justify your answer. [3]

180. 9709_m16_qp_62 Q: 5

In a certain town, 35% of the people take a holiday abroad and 65% take a holiday in their own country. Of those going abroad 80% go to the seaside, 15% go camping and 5% take a city break. Of those taking a holiday in their own country, 20% go to the seaside and the rest are divided equally between camping and a city break.

(i) A person is chosen at random. Given that the person chosen goes camping, find the probability that the person goes abroad. [5]

(ii) A group of n people is chosen randomly. The probability of all the people in the group taking a holiday in their own country is less than 0.002. Find the smallest possible value of n . [3]

181. 9709_s16_qp_61 Q: 3

The probability that the school bus is on time on any particular day is 0.6. If the bus is on time the probability that Sam the driver gets a cup of coffee is 0.9. If the bus is not on time the probability that Sam gets a cup of coffee is 0.3.

(i) Find the probability that Sam gets a cup of coffee. [2]

(ii) Given that Sam does not get a cup of coffee, find the probability that the bus is not on time. [3]

182. 9709_s16_qp_62 Q: 1

Ayman's breakfast drink is tea, coffee or hot chocolate with probabilities 0.65, 0.28, 0.07 respectively. When he drinks tea, the probability that he has milk in it is 0.8. When he drinks coffee, the probability that he has milk in it is 0.5. When he drinks hot chocolate he always has milk in it.

(i) Draw a fully labelled tree diagram to represent this information. [2]

(ii) Find the probability that Ayman's breakfast drink is coffee, given that his drink has milk in it. [3]

183. 9709_s16_qp_63 Q: 1

In a group of 30 adults, 25 are right-handed and 8 wear spectacles. The number who are right-handed and do not wear spectacles is 19.

- (i) Copy and complete the following table to show the number of adults in each category. [2]

	Wears spectacles	Does not wear spectacles	Total
Right-handed			
Not right-handed			
Total			30

An adult is chosen at random from the group. Event X is ‘the adult chosen is right-handed’; event Y is ‘the adult chosen wears spectacles’.

- (ii) Determine whether X and Y are independent events, justifying your answer. [3]

184. 9709_w16_qp_61 Q: 6

Deeti has 3 red pens and 1 blue pen in her left pocket and 3 red pens and 1 blue pen in her right pocket. ‘Operation T ’ consists of Deeti taking one pen at random from her left pocket and placing it in her right pocket, then taking one pen at random from her right pocket and placing it in her left pocket.

- (i) Find the probability that, when Deeti carries out operation T , she takes a blue pen from her left pocket and then a blue pen from her right pocket. [2]

The random variable X is the number of blue pens in Deeti’s left pocket after carrying out operation T .

- (ii) Find $P(X = 1)$. [3]
- (iii) Given that the pen taken from Deeti’s right pocket is blue, find the probability that the pen taken from Deeti’s left pocket is blue. [4]

185. 9709_w16_qp_62 Q: 1

When Anya goes to school, the probability that she walks is 0.3 and the probability that she cycles is 0.65; if she does not walk or cycle she takes the bus. When Anya walks the probability that she is late is 0.15. When she cycles the probability that she is late is 0.1 and when she takes the bus the probability that she is late is 0.6. Given that Anya is late, find the probability that she cycles. [5]

186. 9709_w16_qp_63 Q: 4

For a group of 250 cars the numbers, classified by colour and country of manufacture, are shown in the table.

	Germany	Japan	Korea
Silver	40	26	34
White	32	22	26
Red	28	12	30

One car is selected at random from this group. Find the probability that the selected car is

- (i) a red or silver car manufactured in Korea, [1]
 (ii) not manufactured in Japan. [1]

X is the event that the selected car is white. Y is the event that the selected car is manufactured in Germany.

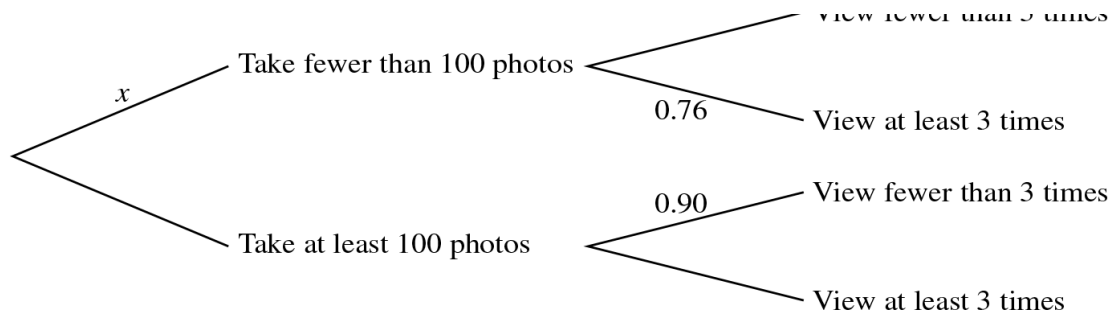
- (iii) By using appropriate probabilities, determine whether events X and Y are independent. [5]

187. 9709_s15_qp_61 Q: 3

Jason throws two fair dice, each with faces numbered 1 to 6. Event A is 'one of the numbers obtained is divisible by 3 and the other number is not divisible by 3'. Event B is 'the product of the two numbers obtained is even'.

- (i) Determine whether events A and B are independent, showing your working. [5]
 (ii) Are events A and B mutually exclusive? Justify your answer. [1]

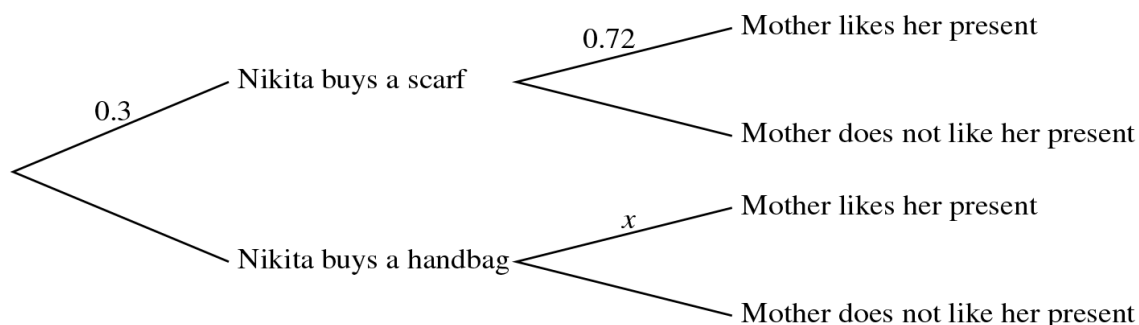
188. 9709_s15_qp_61 Q: 4



A survey is undertaken to investigate how many photos people take on a one-week holiday and also how many times they view past photos. For a randomly chosen person, the probability of taking fewer than 100 photos is x . The probability that these people view past photos at least 3 times is 0.76. For those who take at least 100 photos, the probability that they view past photos fewer than 3 times is 0.90. This information is shown in the tree diagram. The probability that a randomly chosen person views past photos fewer than 3 times is 0.801.

- (i) Find x . [3]
 (ii) Given that a person views past photos at least 3 times, find the probability that this person takes at least 100 photos. [4]

189. 9709_s15_qp_62 Q: 4



Nikita goes shopping to buy a birthday present for her mother. She buys either a scarf, with probability 0.3, or a handbag. The probability that her mother will like the choice of scarf is 0.72. The probability that her mother will like the choice of handbag is x . This information is shown on the tree diagram. The probability that Nikita's mother likes the present that Nikita buys is 0.783.

- (i) Find x . [3]
- (ii) Given that Nikita's mother does not like her present, find the probability that the present is a scarf. [4]

190. 9709_w15_qp_62 Q: 2

A committee of 6 people is to be chosen at random from 7 men and 9 women. Find the probability that there are no men on the committee. [3]

191. 9709_w15_qp_63 Q: 2

In country X , 25% of people have fair hair. In country Y , 60% of people have fair hair. There are 20 million people in country X and 8 million people in country Y . A person is chosen at random from these 28 million people.

- (i) Find the probability that the person chosen is from country X . [1]
- (ii) Find the probability that the person chosen has fair hair. [2]
- (iii) Find the probability that the person chosen is from country X , given that the person has fair hair. [2]

192. 9709_w15_qp_63 Q: 3

Ellie throws two fair tetrahedral dice, each with faces numbered 1, 2, 3 and 4. She notes the numbers on the faces that the dice land on. Event S is 'the sum of the two numbers is 4'. Event T is 'the product of the two numbers is an odd number'.

- (i) Determine whether events S and T are independent, showing your working. [5]
- (ii) Are events S and T exclusive? Justify your answer. [1]

